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International Accounting Standards Board

July 3, 2007

RE: IASB exposure draft on SME's – Comment on defined benefit pension accounting issues
(Paragraphs 27.14 – 27.26)

Dear Sir/Madam,

Janet Morrill, Kevin Shand and I have been working on a paper on pension accounting standards. Based on both the results of our paper and our experience working on the paper, we have a number of comments on the proposed treatment for defined benefit pensions in the IASB exposure draft on Small and Medium sized enterprises (paragraphs 27.14 – 27.16).

Our paper uses simulation analysis to examine the behaviour of pension expense, the pension accrual (i.e., the liability or asset that would have been recorded on the balance sheet under the current Canadian standard, CICA Section 3461) and the funded status of the plan (i.e., the liability or asset that will be presented under the proposed exposure draft). We used "At Risk," a commercial program used by actuaries, that we programmed to generate 5,000 20-year streams of economic data using the Wilkie Model. For each of those streams of economic data, we calculated the pension accounting numbers under various pension accounting alternatives: 1) the current CICA 3461, 2) current CICA 3461 without a corridor, 3) current CICA 3461 using market related values, 4) the proposed IASB standard for SME's, 5) the proposed IASB standard with a corridor, and 6) FRS 17. We ensured that our results held under different types of pension management by examining the impact of holding different percentages of the pension plan in equities (0%, 30%, 60% or 100%) and the impact of two different funding strategies. We considered a minimum funding strategy where the company makes only the minimum required contributions to the plan, or a deficit funding strategy, where the company tries to minimize the liability on their balance sheet.

We examined various characteristics of the accounting numbers. We looked at:

- the volatility of pension expense,
- the representational faithfulness of pension expense:
 - the degree to which pension expense correlated with pension contributions across all companies and all years, and
 - the correlation between pension expense and "non smoothed" pension expense that eliminates all accruals and smoothing mechanisms that some contend mask pension plan performance, and
- the predictive value of pension expense:
 - the correlation between pension expense and the following year's pension expense, and
 - the correlation between pension expense the following year's pension contributions

The advantage of using a simulation approach is that we can examine different accounting standards over a very wide range of economic conditions. Empirical papers that examine the impact of different pension standards, while very useful, are limited in this regard. For example, if you examine the effect of a new standard, you have only a few years of economic results before and after the standard is introduced, all firms experienced the same economic results, and the pension expense numbers could be affected by things such as changes to the plan, changes to the workforce, and so on.

Our findings and recommendations are as follows:

Immediate Recognition of Actuarial Gains and Losses (par 27.22)

Our results quantify the increase in volatility in pension cost that firms would likely experience under the proposed rules in the IASB-SME exposure draft (paragraph 27.21 – 27.22). Our results show that immediate recognition of actuarial gains and losses, as compared to amortization over the expected average remaining service life (EARSLS) as is done in Canada and the US, results in a huge increase in volatility. Imposing such a burden on small and medium sized enterprises seems overly onerous. This is particularly the case for the many SME's that are financed by debt which often carries debt covenants. The likelihood of debt covenant violation generally increases with income volatility.

Our results also indicate that the volatility does not result in substantially better information. In our opinion, our measures of representational faithfulness and predictive value are not appreciably better given the high cost that the increased volatility may entail.

Finally, we found that if the Board chooses to require immediate recognition of actuarial gains and losses, adopting a corridor exemption similar to the Canadian and North American standards offers tremendous advantages. Not only is the volatility substantially reduced, the predictive value and representational faithfulness of pension cost numbers improve.

Reporting the defined benefit liability in the balance sheet (par 27.14 – 27.15)

Our findings indicate that the funded status of the plan (or defined benefit liability) tends to be reasonably highly correlated with the pension accrual item currently reported on the Canadian balance sheet (i. e., total pension cost recognized to date less total pension contributions to date). Specifically, we found that the average Pearson correlation between the balance sheet accrual item and the funded status of the plan ranged between 0.4 and 0.6 for balanced pension plans. This correlation increased significantly for firms that followed aggressive pension funding strategies. Moreover, the magnitudes of the accrued liability and the funded status of the plan are, on average, within 10% of each other for plans with at least some equity holdings.

These findings have some important implications. The conditions in the past few years that gave rise to concerns about the current accounting rules for publicly accountable firms (whereby firms reported small liabilities and even pension assets when their plans were actually underfunded) may have been anomalous. Our results suggest that the current balance sheet pension information under Canadian GAAP is not misleading and there may be no need to change it. Alternatively, the relatively close association between the current balance sheet accrual and the funded status of the plan suggests that the economic consequences of the changes proposed in this exposure draft might be minimal and the

transparency of the balance sheet information might be significantly enhanced.

Economic impact of using a corporate bond rate as a discount rate (par 27.17)

Finally, while doing this paper with Kevin Shand, an actuary, we encountered some difficulties with the handling of the pension liability. Our concerns related especially to the use of a fluctuating corporate bond rate as the discount rate. It is common practice, and in most jurisdictions required, that actuaries calculate the projected benefit obligation (PBO) using the expected rate of return on plan assets while, for accounting purposes, the long term corporate bond rate is used to calculate the PBO.

We understand the theoretical argument for using the bond rate but found that using the bond rate gives rise to an important practical difficulty. Since the expected rate of return is always at least equal to, and generally greater than, the bond rate, the actuarial liability is always equal to or less than the accounting liability. Similarly, the required contributions to the plan calculated by the actuary are always equal to or less than the contributions that would be arrived at if the actuary used the corporate bond rate for the liability. As a result, the contributions to the plan are “insufficient” from an accounting point of view. If companies cannot make greater contributions to their plan than that required by the actuaries on a tax-deductible basis, they face a difficult choice: They must either make excess contributions on a non-tax-deductible basis (highly inefficient), or they must see their accounting liabilities increase significantly. We therefore suggest that the Board seriously consider whether continued use of a long term corporate bond rate is wise.

Please do not hesitate to contact us if you require any further elaboration of these comments, and if we can be of any assistance to the Board in their deliberations. We would also be pleased to send along an electronic copy of our paper if that might be of interest to you (simply e-mail me at Cameron_Morrill@UManitoba.CA).

Thank you for your consideration and for the opportunity to participate in the standard-setting process.

Sincerely,

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Smoothing mechanisms in pension cost standards: A simulation study

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ABSTRACT

Defined benefit (DB) pension plans have received close attention in recent years from the business press, academics and accounting standard-setters. In the United States alone, over 30,000 companies offered DB plans in 2002, at which time these plans held assets in excess of \$1.6 trillion. New or amended pension accounting standards have been adopted in the U.S. (SFAS 158 in 2006) and the United Kingdom (amended FRS 17 in 2006). In 2007, the Canadian Institute of Chartered Accountants released an exposure draft of an amendment to its Handbook pension section and the International Accounting Standards Board has released for comment a proposed pension accounting standard for small- and medium-sized enterprises. In spite of recent efforts toward international harmonization of accounting standards in general, significant differences in pension accounting standards persist.

Critics have charged that recent pension accounting standards have had several negative consequences for companies, their employees and investors. Many of the concerns center around the volatility of pension accounting numbers, the transparency of pension disclosures, and the degree to which pension numbers reflect or mask underlying performance. Mechanisms to reduce volatility, such as the corridor provision in U. S. and Canadian standards, create incentives to overinvest pension funds in equity-based assets and reduce the correlation between recognized pension costs and actual pension contributions. On the other hand, critics charge that abandoning these mechanisms creates unnecessary and undesirable volatility in pension cost numbers.

Our study uses simulated data to test the predictive ability, representational faithfulness and volatility of pension accounting numbers under a variety of accounting approaches. We find that the corridor method combined with amortization of actuarial gains and losses used in Canada and the U. S. has little effect on the predictive ability, representational faithfulness and volatility of pension cost numbers. However, the addition of a corridor to methods using immediate recognition of actuarial gains and losses results in a significant reduction in pension cost volatility and an increase in the predictive ability of pension cost and its correlation with contemporaneous pension funding. The market value related asset valuation option in Canada and the U. S. reduces pension cost volatility, but also eliminates any correlation between pension cost and contemporaneous or next period pension funding. Our results could provide evidence to complement existing, primarily archival research in accounting for post-employment benefits, and guidance for standard-setters grappling with this issue.

Smoothing mechanisms in defined benefit pension cost standards: A simulation study

Many companies continue to offer defined benefit (DB) pension plans which have a significant impact on their bottom line. The assets held in DB pension plans in the United States alone amounted to 1.6 trillion dollars at the end of 2002 (Kuttner, 2003) and such plans are offered by 30,000 companies (Byrnes, 2004). At the end of 2002, the DB pension plans of the S&P 500 companies were under-funded by a total of \$216 billion (Gutner, 2003). Critics have expressed concern that the accounting for these significant plan assets and liabilities can affect how these plans are managed, and even influence a company's decision to offer (or wind up) a DB plan. Given their economic significance and complexity, it is not surprising that pension accounting standards have attracted a great deal of recent attention from, and generated considerable controversy among, standard-setters, companies and users of financial statements.

The accounting standards for defined benefit pension plans have been revised several times, and a fundamental review of all aspects of pension accounting was added to the International Accounting Standards Board's active standard setting agenda in July 2006. In 2006, new or amended standards were released by the Financial Accounting Standards Board in the United States (SFAS 158) and by the Accounting Standards Board in the United Kingdom (amended FRS 17). In 2007, the Canadian Institute of Chartered Accountants (CICA) issued an exposure draft of a revised version of its pension accounting standard (CICA, 3461). Despite concerted and frequently successful efforts to harmonize accounting standards in general, there are still significant differences among the pension accounting standards that have been issued.

In this paper, we compare current and proposed pension accounting standards from Canada and the United States, Britain, and the International Accounting Standards Board

(IASB). Unlike previous pension accounting studies which rely primarily on archival data, we use simulated data that allows us to study the behaviour of pension cost¹ data over a much longer period and to examine the effects of asset allocation, pension funding strategies and macroeconomic conditions. In general, we find that pension accounting methods that reduce pension expense volatility also tend to reduce the correlation between pension expense and cash flow. We also found that there were large variations in the effectiveness of the mechanisms designed to reduce volatility.

The paper is organized as follows. First we describe the key elements of DB pensions and pension accounting under four distinct regimes. Next, we identify pension accounting issues that have surfaced in the recent academic and practitioner literatures, from which we generate research questions. The third section describes our simulation approach. Finally, we present the results of the simulation and draw conclusions.

Pension Accounting

Defined benefit (DB) pension calculations and accounting are both very complex. Pension accounting standards generally require that the cost of pension benefits must be estimated and recorded as they are earned by employees, which in turn requires estimates of the future retirement benefits, expected number of beneficiaries and duration of benefits, etc., all of which is converted to current values using a discount rate. These pension cost figures are adjusted over time as a function of the pension plan's experience and changes in plan-related assumptions. Not surprisingly, recent evidence suggests that analysts and investors have trouble

¹ Recent standards distinguish between “pension cost” and “pension expense.” Pension cost generally includes current service cost, interest cost and some deduction for return on plan assets, and may include amortization of actuarial gains and losses in some jurisdictions (see Table 1 for more discussion of differences among jurisdictions). Pension cost will differ from pension expense if some pension costs are allocated to assets such as inventory. For convenience, we consider pension cost and pension expense to be synonymous.

understanding the link between pension information and earnings (Picconi 2006). In this section, we describe briefly the key elements of pension cost and some of the different pension accounting methods in use today. Our simulation analysis, in turn, will generate pension statistics under various accounting choices.

The key DB pension elements are defined below.

Accrued benefit obligation (ABO): This is the liability of the pension plan, that is, the present value of the future pension benefits that have been earned to date by plan members. Since the pension benefits of many DB plans are often a function of the member's best annual salaries, the ABO is generally the *projected benefit obligation*, which takes into account expected future salary increases.

Discount rate: This is the rate that is used in the ABO present value calculations. Under SFAS 87/CICA 3461, this rate is the current yield on high quality debt instruments that have the same maturity characteristics as the pension plan liability, i. e., a long term zero-coupon bond.

Current service cost: This is the present value of pension benefits earned by employees during the current year. Current service cost is calculated in the same way as, and is added to, the ABO.

Pension plan assets: Pension legislation in many countries generally specifies some minimum level of funding for approved pension plans. These funds are typically managed by a trustee who invests in some combination of debt and equity instruments and pays out pension benefits to retired employees.

Expected return on pension plan assets: This is management's best estimate as to the expected annual long-run return on the pension plan's assets. The expected return will vary with changes in the risk-free rate of return in the economy, the risk premium associated with equity investments and the allocation of pension plan assets.

Actuarial gains and losses: These are gains and losses that arise when actual results vary from actuarial forecasts (e. g., actual return on plan assets in a given year differ from the expected return) or when actuarial assumptions change (e. g., the mortality assumption is altered to reflect that retirees are expected to live longer than had previously been assumed).

Corridor method: Under the corridor method, it is not necessary to charge actuarial gains and losses to pension expense as they occur. Instead, the gains and losses are netted together and only recognized in pension expense if the cumulative net gain or loss exceeds (typically) 10% of the ABO or the pension plan assets as at the beginning of the reporting period, whichever is larger. At a minimum, any excess must be amortized to pension expense over the expected average remaining service life (EARSL) of the employees in the plan.

The differences among pension accounting treatments under Canada/US (CICA 3461/SFAS 158), British (FRS 17) and International standards are presented in Table 1. Two sets of international standards are included in the table: IAS 19, which covers publicly accountable entities; and the proposed standards for small and medium-sized entities (SME) as outlined in the February 2007 IASB exposure draft. In all cases, pension expense includes current service cost and interest cost on the ABO. For all, except the proposed IASB SME standards, expected returns on plan assets are deducted from pension expense. Under the proposed international SME standard, actual, rather than expected, returns on plan assets are deducted from pension expense.

[Insert Table 1 here]

An important difference in standards relates to the treatment of actuarial gains and losses. Under Canadian and US standards, net cumulative actuarial gains and losses that fall outside the 10% corridor must, at a minimum, be amortized to pension expense over the expected average

remaining service life (EARSL) of active employees covered by the plan.² Under UK standards, actuarial gains and losses do not appear on the income statement but rather are charged directly to retained earnings as they occur. IAS 19 allows either treatment (although amortization is over the EARSL of all employees, active and inactive, covered by the plan), but the proposed international SME standard requires that all actuarial gains and losses be charged to pension expense in the period in which they arise.

Finally, the UK and international standards require that expected return on plan assets is a function of expected return and the fair value of plan assets. Canadian and U.S. standards permit the use of either fair value or a market-related value in which changes in the fair value of plan assets are recognized over a period up to five years.. For purposes of calculating the funded status of the plan, all standards require the use of fair value. All standards, either in place or proposed, require that the net surplus or deficit of the plan be reported on the balance sheet.

Pension accounting research questions

Volatility of pension expense

At least two of the features of pension plans can introduce volatility into pension expense. The first is the discount rate applied to the ABO. Under all four accounting alternatives examined here, the discount rate is the market rate applied to high quality debt with characteristics that match those of the pension liability. This discount rate varies with market conditions, effectively marking the ABO to market at the end of each reporting period. The second feature introducing volatility is the treatment of actuarial gains and losses caused by experience that differs from actuarial estimates or by changes in actuarial estimates that reflect

² The amortization of actuarial gains and losses as described here represents the minimum amount of these gains and losses that must be recognized in a given period under Canadian and US GAAP. Any systematic method of recognizing these gains and losses in income that exceeds this minimum, including immediate recognition of all gains and losses, is also permissible.

changing circumstances. We focus on the treatment of actuarial gains and losses in this paper as the four accounting standards we examine require significantly different treatment in this regard.

The proposed international standard for SME's advocates an "unsmoothed" pension expense in which any changes to the funded status of the plan, other than contributions and benefits paid, are charged to expense. This standard contains none of the features contained in the other standards that are designed to reduce volatility. A survey of financial analysts revealed that the majority preferred this type of accounting (Stone, Joy and Thomas, 1995). At least some Canadian firms currently present this unsmoothed expense in the notes to their financial statements. The 2006 financial statement notes for Quebecor Inc., for example, disclose a 2006 pension cost figure of \$15.4 million that is designated "Elements of net benefit costs before adjustments to recognize the long-term nature and valuation allowance" (2006: p. 66).

The "adjustments" to which Quebecor refers above are the provisions of current pension accounting standards that are explicitly designed to dampen pension cost volatility. First, all standards except the proposed international SME standard require the use of a long-run expected return on plan assets in pension cost calculations rather than actual return. The difference between expected and actual returns is part of total actuarial gains or losses which can be amortized to pension expense using the corridor method (Canada/US) or charged directly to retained earnings (Britain). Finally, Canada and the US permit the use of a "smoothed" market-related value of plan assets in calculating the expected return on plan assets.

There is considerable evidence to support the view that managers and investors prefer smoother earnings. A substantial body of accounting literature has documented the phenomenon of income smoothing, defined as manipulating earnings to reduce fluctuations around some level considered normal for the firm (Barnea, Ronen and Sadan 1976). Specifically, management

appears to be motivated to manipulate accounting figures (as well as engaging in other activities, such as strategically timing or entering into certain transactions [Bartov 1993; Mande, File and Kwak 2000; Stone, Joy and Thomas 1995])) in order to reduce income fluctuations. Byrnes (2000) notes that pension income and expenses create a potentially powerful device to smooth earnings.

The income smoothing hypothesis is consistent with the considerable empirical evidence regarding management lobbying on accounting issues in general, and pension accounting in particular. Ndubizu, Choi and Jain (1993), for example, found that corporate lobbying strategy with respect to the revised pension standard SFAS 87 was strongly related to earnings volatility. Firms with higher earnings volatility, relative to a random sample of non-lobbyists, were more likely to lobby against the new standard.

Excessive volatility also decreases the usefulness of accounting earnings for purposes of executive compensation. Banker and Datar (1989) have suggested that precision, defined as the reciprocal of variance of the payoff (in this case, net income), is a desirable characteristic of accounting income for purposes of management contracting. All other things being equal, as precision of net income increases, the proportion of net income to share price in the optimal executive compensation contract also increases. According to this line of reasoning, pension accounting standards that increase volatility of pension expense and, presumably, net income, may adversely affect the usefulness of accounting income for management compensation purposes.

In spite of the arguments presented above, the smoothing provisions in pension accounting have generated considerable controversy. First, provisions such as these allow managers to report smoother earnings that are perceived by many to be of lower quality (Stone,

Joy and Thomas, 1995). Secondly, many critics argued that pension accounting allowed firms to shift income between periods in potentially deceptive ways. During the period that the current Canadian/US standards have been in force, the economic status of DB pension plans has changed considerably and the effect of pension accounting on financial statements has been dramatic. In the years preceding the stock market crash of 2001, many DB plans were in a surplus position (Byrnes 2004). Because pension accounting allowed plan surpluses to be amortized to income over a number of years and allowed firms to estimate an expected rate of return on assets, managers were able to use accounting to perform a kind of “magic” that took previous investment gains into income so as to offset significantly the poor financial performance experienced by many firms in 2001 (Henry 2001).

Moreover, since pension expense was based on *expected*, rather than *actual*, return on plan assets, critics charged that companies were using optimistic expected rates of returns and were thereby disguising the poor performance of the pension plan assets (Terguson 2003). These concerns led the Securities and Exchange Commission to launch an investigation in 2004 of the estimates being used by companies to calculate pension expenses and liabilities (Borrus et al 2004).

Actuaries also suggested that the use of expected rate of return in pension accounting, combined with the corridor method and amortization of actuarial gains and losses, effectively encourage pension plans to overinvest in equities. Higher equity holdings increase the expected return on pension plan assets but also increase the likelihood and volatility of unexpected asset gains and losses. SFAS 87/CICA 3461 requires immediate recognition of expected returns but allows deferral and amortization of unexpected gains and losses. Taken together, pension accounting increases the short term benefits of investing in equities and decreases the short term

accounting consequences, encouraging pension plans to take on more risk than would otherwise be considered prudent (Fore 2004; Gold 2000). It was precisely this overexposure to equity markets, many critics charge, that led to the dramatic deterioration in the financial position of so many DB plans over the period 2000 – 2003.

It is clear from the discussion above that volatility is an important factor in pension accounting decisions. This suggests the following research question:

Question 1. What effect do pension accounting choices have on pension cost volatility?

Representational faithfulness of pension expense

The preceding section investigates the volatility of pension expense and suggests that volatility is generally undesirable. The primary objective of financial reporting, however, is to communicate information that is useful for making resource allocation decisions and/or for assessing management stewardship (CICA HB Section 1000). Therefore, standard setters may be justified in adopting a standard if it is judged to provide useful information, regardless of its effect on the volatility of financial statement numbers.

Faithful representation is a quality of decision-useful financial reporting information (FASB 2006), and is the degree to which information faithfully represents the underlying real-world economic phenomena that it purports to represent. Critics of current US and Canadian accounting standards claim that the smoothing mechanisms adopted to reduce volatility weaken the link between pension expense and pension funding (Fore 2004). Nevertheless, others contend that the removal of smoothing mechanisms would introduce additional volatility into financial statements for little information benefit (Fore 2004) as the long term nature of pension plans means that many changes in pension value will eventually reverse (Wier and Wiedman, 2005). This discussion suggests the following research question:

Question 2. What effect do pension accounting choices have on the association between pension cost and pension funding?³

Predictive ability of pension expense

A second key attribute of decision useful financial information is predictive ability, frequently defined as the ability of an accounting variable to predict future cash flows and/or future accounting outcomes. Our simulation approach allows us to investigate this issue directly and suggests the following research questions:

Question 3. What effect do pension accounting choices have on the association between current pension cost and future pension funding?

Question 4. What effect do pension accounting choices have on the association between current pension cost and future pension cost?

Pension liability

While the pension expense figure on the income statement has attracted significant attention, the pension liability is also controversial. Until recently, the pension liability or asset appearing on the balance sheet was an accrued pension liability or asset, defined as the sum of the current and prior years' benefit costs less the entity's accumulated cash contributions (CICA 3461). The funded status of the plan was only disclosed in the footnotes to the financial statements.

Concerns have been raised regarding the transparency and clarity of the accrued benefit liability (Bryan, Lillien and Mooney, 2007). Early studies show that the market did not properly incorporate information regarding the funded status of pension plans disclosed in the notes to the financial statements (Landsman and Ohlson, 1990), although more recent studies indicate that

³ Pension funding is the appropriate cash flow to consider here. Pension plans pay retirement benefits out of pension plan assets. The payment of these benefits generally has no immediate effect on the sponsoring company.

this information is reflected in security prices, particularly when plans are in a deficit position (Wiedman and Wier, 2004). Furthermore, it was possible for companies to have a balance sheet liability far less than the amount by which the DB plan is underfunded, raising concerns that the new accounting standards requiring placement of the funded status on the balance sheets would have a significantly negative impact on key financial statement ratios and could trigger debt covenant violations (Bryan, Lilien and Mooney, 2007). Our final two research questions are as follows:

Question 5. How strong is the association between the pension accrual and the funded status of the pension plan?

Question 4. What is the magnitude of the pension accrual relative to the funded status of the pension plan?

Methodology

The behaviour of the pension expense is examined by stochastically simulating the pension fund's investment returns using alternative funding contribution policies and a simplified defined benefit pension plan model, the terms of which are presented below.

For the purposes of this analysis, the Pension Expense for the year $t + 1$ reflects the following four components:

- (i) Current Service Cost, representing the current actuarial value at the beginning of the year of the in-year benefit obligations accrued by the plan membership. The Current Service Cost (CSC_t) for the year is determined using the prescribed Projected Unit Credit Method

and discount rate, i_{pe} , where i_{pe} is represented by the long term expected yield on high quality corporate bonds. The discount rate is reviewed annually.

- (ii) Interest Cost, representing the expected interest growth during the year on the plan's accrued and in-year benefit obligations (CSC_t) reduced by those in-year obligations that have been satisfied. The accrued benefit obligation is determined at time t (ABO_t) again using the Projected Unit Credit Method and discount rate, i_{pe} . In-year obligations that have been satisfied are the Plan's benefit payments (B_t).
- (iii) Expected Investment Income, representing the expected investment income generated during the year by the pension fund (F_t) and in-year transactions. The expected investment income is based on the expected annual rate of return for the fund, r . The fair market value or a market related smoothed value (over the maximum allowable period of five years) can be used.
- (iv) Amortization Costs, representing amortization of actuarial gains and losses. Actuarial gains/losses are produced when actuarial assumptions are not realized. Under Canadian and U.S. standards, these gains/losses can be amortized to pension expense (AP_t) over the expected average service lifetime ($EARSL$) of the group in order for the plan to eventually revert back to its assumed state. Recognition is dependent on whether the accumulated unrecognized gains/losses to date ($unrecog.g/l_t$) exceed a pre-established corridor ($corr_t$).

Pension benefits under the model plan are defined at retirement according to a formula expressed as a function of plan service and salary. For funding purposes, the actuarial present value, as at time t , of the projected pension benefit accrued during year $t + 1$, is referred to as a Normal Cost (NC_t) and is calculated, in this paper, using the Projected Unit Credit Method. The actuarial present value, as at time t , of the projected pension benefits accrued to date is referred to as the

Funding Liability (FL_t) and is calculated using the same method. An actuary calculates both the Normal Cost and the Funding Liability using the following actuarial assumptions:

- (i) A discount rate (i_v) that is equivalent to the annual long-term expected rate of return on plan assets (r ; note that this is different from the rate, i_{pe} , that is based on bond-yields and used for accounting purposes), and
- (ii) A salary increase rate (π_v) that is equivalent to the annual long-term expected rate of salary inflation, s , and merit increases, m . In-year actuarial gains or losses produced by the difference between actual and expected salaries for the year are, in practice, quite small and contribute very little to the volatility in the contribution rate and in the reporting of the pension expense.

When investment experience during the year is greater (less) than that assumed, an investment/asset gain (loss) occurs. Alternatively, when the salary increase experience during the year is greater (less) than that assumed, a salary/liability loss (gain) occurs. Typically, these actuarial gains/losses are made up over a specified period through Special Payments (SP). Therefore, the annual contribution to the pension plan is equal to Normal Service Cost, plus Special Payments related to net actuarial losses, less contribution reductions related to net actuarial gains.

Within the model plan, the pension benefit is set at 2% times the member's final year's salary times the number of years of credited service. At retirement, an immediate annuity benefit (B_t) is purchased on behalf of the member at fixed purchase rates assuming i_{pe} and post-retirement mortality consistent with traditional annuitant mortality tables.⁴ Retirement age is strictly at age 60 with no possibility of pre-retirement exit. Members join the plan at age 20 and

⁴ Group Annuitant Mortality Table, 1983 (GAM83) and 50% unisex representation

therefore accrue 40 years of credited service at retirement. Initial salaries at time $t = 0$ are set using a fixed merit scale. The plan membership remains stable at 40 active members with one member at each age, (20) to (59), inclusive. This stable plan membership produces a stable pattern of Normal Costs, Funding Liabilities and Benefit Payments as follows:

$$NC_{t+1} = NC_t \cdot (1 + s_t), \quad FL_{t+1} = FL_t \cdot (1 + s_t) \quad \text{and} \quad B_{t+1} = B_t \cdot (1 + s_t),$$

where s_t represents the actual salary inflation increase during year t and the annual pre-retirement discount rate (i_v) is assumed to be unchanged.

In addition, the Current Service Cost and Accrued Benefit Obligation for pension expense purposes then become:

$$CSC_{t+1} = CSC_t \cdot (1 + s_t) \quad \text{and} \quad ABO_{t+1} = ABO_t \cdot (1 + s_t),$$

when the annual discount rate (i_{pe}) is assumed to be unchanged.

This simplified model is similar to the approach introduced by Dufresne (1988, 1989). In reality, the above model represents a very limited number of plans. However, its most attractive feature is that it produces results that are tractable and focuses the analysis on how investment returns affect the pension expense. Consequently, the influence of demographic outcomes is ignored. Demographic experience does have an effect on contribution rates and on the pension expense but in general, these effects are minimal and not believed to materially affect the results to follow.

The asset allocation strategy of the pension fund is to maintain fixed proportions in each of the available asset classes. This regular re-balancing of the fund's portfolio will consider itself only with equity and long-term bond investments. Various portfolio mixes will be considered in the analysis. At the beginning of the analysis (time $t = 0$), the pension fund (F_0) is assumed to be equal to the Accrued Benefit Obligation (ABO_0), thereby eliminating any transitional benefit

obligations that are not affected by actuarial gains/losses but would nevertheless adversely affect the results of the analysis.

A funding valuation is to be performed each year under two alternative special payment funding strategies in order to determine the appropriate annual contribution amount at the beginning of the year:

- (i) Minimum Funding Strategy: Actuarial gains and losses are amortized with level annual payments over a period of five years. This is a typical approach used in many Canadian jurisdictions and allows surplus withdrawal through contribution reductions. Empirical evidence suggests that firms generally do take contribution reductions when available to them. Furthermore, regulations in most jurisdictions generally encourage firms to withdraw surpluses through contribution reductions, as otherwise the firm runs the risk of not being able to extract the surpluses left in a pension plan. Therefore, firms in these jurisdictions wanting to minimize their cash flows and/or to defer them as long as possible could well adopt a strategy such as this. Special payments for actuarial losses are only required where the plan is in a deficit position. Such an approach was advocated by Frankfurter et al (1981). There is also empirical support to suggest that this is a popular strategy. Lanoie and Arvin (1994) examined pension funding levels in Canada and found strong evidence that firms deliberately under-fund their pension plans.
- (ii) Deficit Funding Strategy: Actuarial gains and losses are amortized with level annual payments over a period of five and one year(s), respectively. This funding strategy could be attractive to firms for at least two reasons. First, the new pension standards require that the unfunded status of a pension plan, if any, be recognized on the balance sheet as a liability. Past research has shown that this is a consideration in firms' pension funding decisions

(Malley and Jayson, 1986). More generally, highly leveraged firms would find deficit funding of the pension plan an attractive way to reduce firm leverage since pension funding is usually tax-deductible. Secondly, firms might wish to fund deficits immediately to signal their financial strength or commitment to employees, securities markets or labour markets, or to appease powerful labour unions. We still use a five year period for actuarial gains, however, as firms are generally prohibited from withdrawing these gains from the pension plan directly. Instead, they can only recoup the gains by taking contribution reductions, typically over five years.

The Special Payment at time t , for the actuarial gain/loss experienced during prior years, under the Minimum Funding Strategy (SP_t^{Min}) will be calculated as follows:

$$SP_t^{Min} = \sum_{j=t-4}^t \frac{gain_{j-1}}{\ddot{a}_{\bar{5}|i_v}} - I_t(0,1) \times \left(\sum_{j=t-4}^t \frac{loss_{j-1} \times I_j(0,1)}{\ddot{a}_{\bar{5}|i_v}} \right),$$

where $\ddot{a}_{\bar{5}|i_v}$ is the amortization factor and $I_j(0,1)$ is a indicator scalar function equal to 0 when the plan is in a surplus position ($F_j > FL_j$) or equal to 1 if a deficit exists.

Under the Deficit Funding Strategy, the special payment at time t ($SP_t^{Deficit}$) will be:

$$\begin{aligned} SP_t^{Deficit} &= \sum_{j=t-4}^t \frac{gain_{j-1}}{\ddot{a}_{\bar{5}|i_v}} - I_t(0,1) \times \left(\sum_{j=t}^t \frac{loss_{j-1} \times I_j(0,1)}{\underbrace{\ddot{a}_{\bar{1}|i_v}}_{=1}} \right) \\ &= \sum_{j=t-4}^t \frac{gain_{j-1}}{\ddot{a}_{\bar{5}|i_v}} - I_t(0,1) \times loss_{t-1}. \end{aligned}$$

As a result, the plan sponsor's beginning-of-year contribution for year $t+1$ (C_t) is represented by

$$C_t = NC_t - \left[\sum_{j=t-4}^t \frac{gain_{j-1}}{\ddot{a}_{\bar{5}|i_v}} - I_t(0,1) \times \left(\sum_{j=t-(0 \text{ or } 4)}^t \frac{loss_{j-1} \times I_j(0,1)}{\ddot{a}_{\bar{1 \text{ or } 5}|i_v}} \right) \right],$$

while the Pension Expense for year $t + 1$ (PE_{t+1}) is represented by:

$$\begin{aligned}
 PE_{t+1} &= CSC_t + i_{pe} \times (ABO_t + CSC_t - B_t) - r \times (F_t + C_t - B_t) - AP_t \\
 &= CSC_t + \text{interest cost} - \text{expected income} - \frac{\text{unrecog.g} / l_t - \text{corr}_t}{EARSL} \\
 &= CSC_t + \text{interest cost} - \text{expected income} - \left[\frac{\sum_{j=2}^t \text{gain}_{j-1} - \sum_{j=2}^t \text{loss}_{j-1} - \sum_{j=1}^t AP_j - \text{corr}_t}{EARSL} \right]
 \end{aligned}$$

Long-term economic assumptions have been derived using a stochastic investment model imputed with Canadian parameters as described by Wilkie (1995)⁵. The asset allocation strategy of the pension fund is to maintain fixed proportions in each of the two available asset classes: long-term bonds and equity. Four portfolio mixes will be considered in the analysis: 0%, 30%, 60% and 100% equity. While in reality plans can use a wide variety of asset mixes, we chose only four to make our results more manageable. The 0% equity alternative is in fact favoured by many actuaries. In the U.K., for example, the pharmacy giant Boots made the controversial decision to adopt such an allocation to reduce the volatility caused by FRS 17 (Wiedman and Weir, 2005). We included the 30% and 60% scenarios to represent the large majority of plans that adopt a blended portfolio, although at varying portions, and we included a 100% equity strategy to study the maximum effects of exposure to the fluctuations in market returns.

Future salary realizations are assumed to equal expectations, thereby reducing the actuarial gains/losses for funding and expensing purposes to strictly investment experience. The *EARSL* for this stable population is fixed at 20.5 years. Future investment returns are forecasted using the same Wilkie model.

⁵ We also ran our entire set of simulations using identical independent distributions (i.i.d) set to the same parameter values as Wilkie. All our results were substantially the same.

Results

The various scenarios that we modelled are described in Table 3. The pension accounting scenarios that we examined were: 1) the current SFAS 158 and the proposed CICA section 3461; 2) SFAS 158 or the proposed CICA 3461 without the corridor option; 3) SFAS 158 and the proposed CICA 3461 using market value related valuation of pension assets rather than fair market values; 4) the proposed IASB standard for small and medium sized non-public enterprises (SME's) that calls for "unsmoothed" pension cost; 5) a hypothetical standard modifying the IASB standard for SME's to allow for a corridor; and 6) FRS 17 used in the U.K. We calculated our results for each regime under our two alternate funding strategies (i.e., "minimum funding" or "deficit funding") and under four different portfolio equity/long term bond asset allocations (i.e., 0% equity, 30% equity/70% bonds, 60% equity/40% bonds, and 100% equity).

Pension Expense Volatility

The graphs comparing the standard deviation of pension expense, σ , over the 20-year period under the different funding strategies and for different asset allocations are presented in Figure 1 (Minimum Funding scenarios) and Figure 2 (Deficit Funding scenarios). Volatility in all cases increased over time, and appeared to be affected very little by funding strategy. Volatility increased somewhat as the percentage of the portfolio invested in equity assets increased, particularly under the SME standard proposed by the IASB (4).

Volatility measures were similar for both 0% equity and 30% equity investments, indicating that going from 30% equities to 0% equities yields little advantage in this regard. The volatility does increase substantially at the 60% equity level, however. At 100% equities, the σ

measures for the immediate recognition (SME) scenario do not even appear on our graphs as the volatility measures are well above the maximum value on our vertical scale of \$2,000,000.

However, as long as actuarial gains and losses are amortized over the EARSL, volatility does not appear to increase appreciably as the equity proportion increases.

In all cases, the volatility was highest by a very significant amount under the proposed IASB standard for SME's. The Canada/U.S. standards had much lower volatility and the use of market related values dampens volatility even further. It is interesting that the use of a market related value could potentially have a material impact but companies are not required to disclose that they are using it.

Removal of the 10% corridor provision from SFAS 158/CICA 3461 had very little impact on volatility. This is an interesting result since the objective of the corridor provision was to reduce pension cost volatility. However, applying the corridor to pension cost under the SME standard proposed by IASB removes approximately one-third to one-half of the volatility. It seems that the corridor approach could be quite useful in dampening pension cost volatility in conjunction with immediate recognition of gains and losses.

Faithful representation of pension expense

In order to investigate the faithful representation of pension expense, we calculated the correlation of pension expense with cash flows and pension expense with "unsmoothed" pension expense (i. e., the pension expense that is proposed in the IASB's SME exposure draft). Those correlation coefficients, averaged across our 5,000 simulated trials and averaged over the 20-year period, are presented in Table 4.

With respect to the correlation between pension expense and cash flows, the accounting approaches that incorporate smoothing performed significantly better, with the exception of

CAN/USA market related values. Those correlations were higher under a minimum funding strategy, which is not surprising, given that the minimum funding strategy would normally result in smoother cash flows as actuarial gains and losses would either reduce or increase contributions to the pension fund over a five year period. Correlations are also affected by the asset allocation strategy: Generally, the correlations weakened as the percentage of the plan invested in equities increased. Therefore, at least to some extent, the quality of pension accounting results depends on the characteristics of the pension plan and how it is managed, as well as the pension accounting choices.

Removing the corridor exemption for actuarial gains and losses from CICA 3461 resulted in a marginal improvement in correlations. Our volatility analysis showed that the corridor reduced volatility, but again by only a small amount. The corridor approach appears to offer tradeoff between volatility and representational faithfulness, but the improvements and decrements appear to be very small.

The effect of adding a corridor to the SME regime is much more dramatic. Adding the corridor results in a dramatic *improvement* to the correlations, while at the same time *decreasing* volatility. This result indicates that adding a corridor exemption to the proposed SME standard is pareto optimal.

Our results indicate that the trade-off re-emerges in the case of market related values. While the use of a market related value decreased volatility, it virtually eradicates representational faithfulness as indicated by the zero and frequently negative correlations with cash flows. We should note, however, that the negative correlations between pension expense and contributions were found in the deficit funding scenarios, and these statistics somewhat overstate the problem. The correlation between pension expense and contributions are very

negative, close to -1.0, in the first five years of our funding period as only one-fifth of changes in the fair value of plan in a given year are recognized when using market-related values.

Therefore, pension expense does not attain a “steady state”, whereby five years of changes in fair value are included in the expense number, until year five. Under deficit funding, however, actuarial losses occurring in a year are added to pension contributions the following year, causing the very negative correlations. Excluding the first five years of correlations for the MV related scenarios increases the negative correlations between pension expense and contributions to a level closer to zero: nevertheless, the representational faithfulness of the MV related scenario is substantially weaker than the representation faithfulness of the fair value scenarios.

Finally, the correlations between pension expense and unsmoothed pension expense were all fairly low, except for the SME scenario (which is unsmoothed expense, hence the perfect correlation) and SME with a corridor. Adding a corridor to the SME scenario did decrease the correlations, as expected. Nevertheless, the correlations in the SME-with-corridor were significantly higher than in the North American standards, which smooth actuarial gains and losses over the EARSL, and the U.K. standard, which excludes actuarial gains and losses from pension expense.

Predictive Ability of Pension Expense

In order to investigate the ability of pension expense to predict future cash flow or future pension expense, we calculated the serial correlation of pension expense with the subsequent period pension expense and pension contributions. Those correlation coefficients, averaged across our 5,000 simulated trials, are presented in Table 5.

The ability of pension expense to predict future cash flows varied significantly according to the pension accounting scenario, the funding strategy, and the asset allocation of the pension

plan. Pension expense had higher correlations with future contributions under a minimum funding strategy, which could be expected given that a minimum funding strategy would tend to result in a less variable stream of cash flows. Similarly, the serial correlations between pension expense and next-period cash flows were higher when less of the pension plan assets were invested in equities. This result has strong intuitive appeal as the actuarial gains and losses and hence the stream of pension contributions would be less volatile as the plan assets are invested more heavily in debt instruments. The Canadian and U.S. standards had the highest correlations, indicating that amortizing actuarial gains and losses over the EARSL improves predictive value. That predictive value would be improved further if the corridor provision was removed. Finally, using a market related value virtually eliminates the correlation between pension expense and future cash flows.

The ability of the IASB proposed pension expense for SME's to predict future cash flows is very weak under deficit funding, although is quite good under minimum funding. Interestingly, adding a corridor improves that predictive ability substantially, while the corridor decreases performance under the CICA/FASB accounting.

The ability of pension expense to predict future pension expense was unaffected by pension strategy or asset allocation. The Canadian and U.S. standards performed quite well. Either retaining or eliminating the corridor had little effect, and using market related values improved the correlations with future expenses. Once again, adding a corridor to the SME standard improved its predictive ability in this regard by a substantial margin.

The predictive ability associated with the U.K. standard is quite interesting. Since actuarial gains and losses affect future pension contributions but are excluded from pension expense under FRS 17, one would expect, and we found, correlations with future cash

contribution to be quite low. However, it could also be expected that the correlations with future pension expense would be very high as the remaining components of pension expense (service costs, interest on the liability, and expected return on assets) are smooth and predictable. These correlations were very high, but they were not very different from the correlations under the Canadian and U.S. standards which incorporate amortized actuarial gains and losses.

Pension Liability

Our last set of research questions addresses the new feature of all the standards which have been recently proposed or adopted requiring that the funded status of pension plans be shown on the balance sheet. Recall that before approximately 2004, the only liability (asset) appearing on the balance sheet was an accrued liability (prepaid asset) representing the cumulative shortfall (excess) of pension expense compared to pension contributions. The notion that the funded status of the plan is more relevant appears to have general acceptance, although concern has been expressed that the size of this liability will have a detrimental effect on the health of corporate balance sheets.

Our results addressing this issue are found in Tables 6 to 8. The descriptive statistics for the pension deficit (the projected benefit obligation less plan assets) and the pension accrual (the cumulative shortfall (excess) of pension expense compared to pension contributions) are shown in Panels 1 and 2 of Table 6. Note that the pension deficit is the same under all pension accounting scenarios as it is based on pension plan assets, which are in turn based on contributions to the plan and the return earned on those contribution, and the projected benefit obligation. These amounts are determined by actuarial calculations and funding policies and are not affected by the accounting for pension plans.

The results in tables 7 and 8 indicate that fears regarding the potentially negative impact

of disclosing the funded status of DB pension plans are greater than warranted. The correlations between the accrual and the deficit in Table 7 are reasonably high, particularly with plans with higher equity content. In addition, Table 8 shows that when equity is introduced into the pension fund, the ratio of the accrual to the deficit is very close to 1 in nearly all cases, indicating that the liability associated with DB pension plans is unlikely to change dramatically when companies are required to show the funded status. At 0% equity under Canadian and U.S. standards, both the accrual and the deficits were small in absolute terms but the ratio was quite high

We believe this highlights an important advantage of our simulation methodology. Concerns were raised post-2001 that companies showed very low liabilities (and in some cases, a pension asset) when their plans were actually underfunded, and requiring companies to show the funded status of their plans on the balance sheet would be very detrimental (Bryan, Lilien and Mooney, 2007). Our results suggest that this is likely due to a particular combination of economic circumstances that all firms experienced in those years. Over a wide range of economic scenarios, the differences between the accrual and the funded status are much less significant.

Overall assessment

Overall, our results indicate that measures that reduce volatility (a corridor, using market related values, amortization over the EARSL) tend to do so at the expense of representational faithfulness and predictive ability. Amortization of actuarial gains and losses over the EARSL has the greatest impact on volatility. Allowing firms to exempt gains and losses from amortization that fall inside a corridor has very little impact. The corridor does not reduce volatility very much, nor does it impair predictive value or representational faithfulness to a

significant degree. However, applying a corridor to pension accounting scenarios requiring immediate recognition of gains and losses (currently proposed by the IASB for SME's) dominates the non-corridor alternative as it significantly: 1) reduces volatility, 2) increases representational faithfulness, and 3) increases predictive ability, as measured by our criteria.

Finally, allowing firms to use market related values in combination with amortization of actuarial gains and losses, as allowed in Canada and the U.S., reduces volatility but detracts from representational faithfulness and the ability of pension expense to predict future cash flows. Standard-setters might want to reconsider the usefulness of the market value related option or, at a minimum, might consider requiring that firms disclose which valuation option they choose.

Conclusions

In this paper, we investigate the behaviour of the pension accounting expense under various accounting treatments using simulated data. By doing so, we are able to examine the characteristics of this expense over a 20 year period under many different economic realizations and under different combinations of economic decisions made by fund managers regarding contributions and asset allocation.

Our findings indicate that the corridor exemptions currently in place in Canada and the U.S. make very little difference either to the volatility of pension expense or to the correlation between pension expense and various predictive ability and representational faithfulness benchmarks. We also find that pension accounting treatments requiring accelerated recognition of actuarial gains and losses dramatically increase the volatility of pension expense. Combining a corridor exemption with accelerated recognition appears to be pareto-optimal in that it reduces volatility and improves predictive ability and representational faithfulness.

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Table 1. Key Pension Accounting Differences – Canada/US vs. British vs. International Standards

Item	Canada/US	Britain (FRS 17)	International (IAS 19)	International (Proposed SME)
Pension cost	= Current service cost + Interest cost - Expected return on plan assets +/- Actuarial gains/losses recognized	= Current service cost + Interest cost - Expected return on plan assets	Either Canada/US or British approach accepted	= Current service cost + Interest cost - Actual return on plan assets +/- Actuarial gains/losses arising in period
Actuarial gains and losses	Charged to expense – corridor method allowed	Charged to retained earnings	Either Canada/US or British approach accepted	Charged to expense as they arise
Maximum amortization of actuarial gains and losses	Expected average remaining service life of active employees covered by plan	N/A	Expected average remaining service life of all employees (active and inactive) covered by plan	N/A
Plan assets valuation in calculation of expected return	Fair value or market-related value	Fair value	Fair value	N/A

Notes

The Canada/US standards are outlined in CICA 3461 and SFAS 87, 106 and 158. The proposed SME standards are taken from the February 2007 IASB *Exposure Draft of a Proposed IFRS for Small and Medium-sized Entities*.

Table 2. Modelling of Pension Expense

Components of Pension Expense	Determined by:		
	Exogenous Factors	Exogenous Pension Accounting Characteristics	Endogenous
Current Service Cost	<ul style="list-style-type: none"> • Salary inflation (fixed) 		
+ Interest on Projected Benefit Obligation (PBO)	<ul style="list-style-type: none"> • Discount Rate (fixed) 		<ul style="list-style-type: none"> • PBO
- Return on Plan Assets	<ul style="list-style-type: none"> • Rate of Return (ROR) (random) 	<ul style="list-style-type: none"> • Funding strategy • Expected return on FMV of plan assets 	<ul style="list-style-type: none"> • Assets • Net actuarial gains/losses
+/- Recognized gains and losses	<ul style="list-style-type: none"> • ROR (random) • Discount rate (fixed) 	<ul style="list-style-type: none"> • Corridor vs. no corridor • EARSL vs. immediate recognition vs. 1 year amortization • Expected return on FMV of plan assets or market based value of plan assets 	<ul style="list-style-type: none"> • Assets • Liabilities

Table 3. Description of Model Scenarios

Pension Accounting Scenarios				
#	<i>Legend Description</i>	<i>Amortization of actuarial gains/losses</i>	<i>Expected vs. actual return on plan assets</i>	<i>Corridor vs. no corridor</i>
1)	CAN/USA FMV	EARSL	Expected	Corridor
2)	CAN/USA no corridor	EARSL	Expected	No corridor
3)	CAN/USA Market value (MV) related	EARSL	Expected return on MV based assets	Corridor
4)	SME	Immediate	Actual	No corridor
5)	SME, corridor	Immediate	Actual	Norridor
6)	U.K.	None	Expected	N/A
Funding Scenarios				
<p>1. Minimum Funding</p> <ul style="list-style-type: none"> • actuarial losses made up over 5 years if plan is in deficit position • actuarial gains withdrawn over 5 years through contribution reductions • actuarial gains and losses based on MV related value of plan assets in scenario 3 and the Fair Market Value of plan assets in all other scenarios <p>2. Deficit Funding</p> <ul style="list-style-type: none"> • actuarial losses made up immediately if plan is in deficit position • actuarial gains withdrawn over 5 years through contribution reductions • actuarial gains and losses based on MV related value of plan assets in scenario 3 and the Fair Market Value of plan assets in all other scenarios 				
% of portfolio invested in equities				
<p>1. 0%</p> <p>2. 30%</p> <p>3. 60%</p> <p>4. 100%</p>				

Notes

EARSL is Expected Average Remaining Service Life of employees.

Table 4. Correlations based on 20 year average

	CAN/ USA FMV	CAN/ USA no corridor	CAN/ USA MV related	SME	SME corridor	U.K.
<u>Minimum Funding</u>						
0% Equity						
ρ (expense, cash flow)	0.78	0.82	0.01	0.21	0.52	0.52
ρ (expense, no smoothing expense)	0.25	0.25	0.09	1.00	0.80	0.22
30% Equity						
ρ (expense, cash flow)	0.70	0.76	0.01	0.11	0.48	0.50
ρ (expense, no smoothing expense)	0.19	0.19	0.14	1.00	0.74	0.19
60% Equity						
ρ (expense, cash flow)	0.64	0.69	-0.03	0.01	0.35	0.48
ρ (expense, no smoothing expense)	0.15	0.14	0.16	1.00	0.77	0.18
100% Equity						
ρ (expense, cash flow)	0.57	0.60	-0.08	0.00	0.23	0.40
ρ (expense, no smoothing expense)	0.18	0.17	0.18	1.00	0.86	0.21
<u>Deficit Funding</u>						
0% Equity						
ρ (expense, cash flow)	0.58	0.63	-0.27	0.15	0.48	0.31
ρ (expense, no smoothing expense)	0.23	0.23	0.07	1.00	0.80	0.20
30% Equity						
ρ (expense, cash flow)	0.50	0.56	-0.23	0.07	0.44	0.31
ρ (expense, no smoothing expense)	0.17	0.16	0.13	1.00	0.74	0.18
60% Equity						
ρ (expense, cash flow)	0.46	0.51	-0.26	0.01	0.37	0.29
ρ (expense, no smoothing expense)	0.13	0.12	0.15	1.00	0.78	0.16
100% Equity						
ρ (expense, cash flow)	0.41	0.45	-0.26	0.01	0.28	0.25
ρ (expense, no smoothing expense)	0.17	0.16	0.15	1.00	0.86	0.21

Table 5. Serial correlations based on 5,000 simulated 20-year trials

	CAN/ USA FMV	CAN/ USA no corridor	CAN/ USA MV related	SME	SME corridor	U.K.
<u>Minimum Funding</u>						
0% Equity						
ρ (expense[t], cash flow[t+1])	0.76	0.79	-0.01	0.57	0.76	0.55
ρ (expense[t], expense[t+1])	0.84	0.83	0.92	0.19	0.51	0.85
30% Equity						
ρ (expense[t], cash flow[t+1])	0.69	0.73	0.02	0.52	0.75	0.54
ρ (expense[t], expense[t+1])	0.82	0.82	0.92	0.12	0.48	0.85
60% Equity						
ρ (expense[t], cash flow[t+1])	0.65	0.69	0.00	0.46	0.68	0.52
ρ (expense[t], expense[t+1])	0.79	0.78	0.92	0.10	0.43	0.82
100% Equity						
ρ (expense[t], cash flow[t+1])	0.60	0.63	-0.05	0.43	0.60	0.46
ρ (expense[t], expense[t+1])	0.68	0.68	0.91	0.12	0.40	0.69
<u>Deficit Funding</u>						
0% Equity						
ρ (expense[t], cash flow[t+1])	0.48	0.53	-0.21	0.10	0.31	0.19
ρ (expense[t], expense[t+1])	0.79	0.79	0.83	0.16	0.48	0.77
30% Equity						
ρ (expense[t], cash flow[t+1])	0.40	0.45	-0.19	0.02	0.26	0.20
ρ (expense[t], expense[t+1])	0.83	0.83	0.87	0.09	0.44	0.86
60% Equity						
ρ (expense[t], cash flow[t+1])	0.33	0.38	-0.21	-0.06	0.14	0.17
ρ (expense[t], expense[t+1])	0.80	0.79	0.85	0.07	0.40	0.83
100% Equity						
ρ (expense[t], cash flow[t+1])	0.26	0.30	-0.28	-0.07	0.04	0.10
ρ (expense[t], expense[t+1])	0.68	0.68	0.71	0.10	0.38	0.68

Table 6. Panel 1: Funded Status Statistics

	Minimum Funding				Deficit Funding			
	0% equity	30% equity	60% equity	100% equity	0% equity	30% equity	60% equity	100% equity
All scenarios								
Mean	553	935	1,697	2,807	27	553	1,228	2,287
Minimum	-19,096	-8,583	-4,571	-4,786	-16,009	-9,393	-4,571	-3,688
Maximum	4,007	4,492	6,207	13,604	4,812	3,944	5,985	12,530
S.D.	857	628	842	1,505	787	548	773	1,495

Notes

All amounts are in thousands. Negative numbers indicate underfunding.

Table 6 (continued). Panel 2: Accrued Liability/Deferred Asset Statistics

	Minimum Funding				Deficit Funding			
	0% equity	30% equity	60% equity	100% equity	0% equity	30% equity	60% equity	100% equity
CAN/USA FMV								
Mean	666	964	1,642	2,653	136	602	1,221	2,212
Minimum	-4,083	-3,588	-4,526	-6,896	-6,579	-5,399	-4,989	-8,050
Maximum	20,155	9,834	11,397	19,868	19,211	10,155	11,256	19,050
S.D.	1,659	1,530	2,017	3,176	1,906	1,653	2,120	3,364
CAN/USA No corridor								
Mean	680	975	1,655	2,669	145	607	1,226	2,217
Minimum	-3,759	-3,275	-4,182	-6,557	-6,255	-5,062	-4,704	-7,708
Maximum	19,605	9,486	10,983	19,398	18,717	9,775	10,842	18,580
S.D.	1,513	1,422	1,941	3,109	1,774	1,550	2,041	3,297
CAN/USA MV related								
Mean	700	971	1,617	2,591	161	611	1,206	2,153
Minimum	-6,431	-5,761	-6,893	-10,810	-9,377	-7,781	-7,760	-13,733
Maximum	32,564	16,235	13,863	24,255	30,418	17,015	13,755	23,637
S.D.	2,292	2,014	2,503	3,842	2,579	2,170	2,670	4,142
SME								
Mean	553	934	1,696	2,794	26	553	1,226	2,274
Minimum	-19,096	-8,583	-4,571	-5,285	-16,009	-9,393	-4,571	-4,602
Maximum	4,007	4,492	6,207	13,604	4,812	3,944	5,985	12,530
S.D.	1,799	1,808	2,541	3,979	1,626	1,607	2,308	3,754
SME Corridor								
Mean	508	883	1,593	2,657	17	534	1,164	2,189
Minimum	-16,354	-6,993	-3,065	-4,882	-13,568	-7,733	-3,065	-4,224
Maximum	4,320	4,289	6,547	13,160	5,215	4,156	6,230	12,088
S.D.	1,191	1,261	1,986	3,407	1,087	1,123	1,774	3,193
UK								
Mean	712	985	1,644	2,635	176	622	1,226	2,203
Minimum	-5,736	-5,113	-6,113	-9,160	-8,544	-6,688	-6,687	-11,106
Maximum	27,004	13,176	13,567	23,606	25,422	13,786	13,444	22,741
S.D.	2,020	1,769	2,245	3,508	2,263	1,883	2,346	3,685

Notes

All amounts are in thousands. Negative numbers indicate a deferred asset.

Table 7. Correlations between deficit and accrual based on 20-year average

	CAN/ USA FMV	CAN/ USA no corridor	CAN/ USA MV related	SME	SME corridor	U.K.
<u>Minimum Funding</u>						
0% Equity	0.27	0.29	0.22	1.00	0.87	0.28
30% Equity	0.44	0.47	0.36	1.00	0.89	0.43
60% Equity	0.59	0.60	0.48	1.00	0.93	0.56
100% Equity	0.65	0.67	0.54	1.00	0.96	0.62
<u>Deficit Funding</u>						
0% Equity	0.25	0.71	0.23	1.00	0.80	0.26
30% Equity	0.36	0.82	0.32	1.00	0.83	0.36
60% Equity	0.49	0.90	0.43	1.00	0.91	0.48
100% Equity	0.58	0.91	0.50	1.00	0.96	0.55

Table 8. Ratio of Accrual to Deficit

	CAN/ USA FMV	CAN/ USA no corridor	CAN/ USA MV related	SME	SME corridor	U.K.
<u>Minimum Funding</u>						
0% Equity	1.20	1.23	1.26	1.00	0.92	1.29
30% Equity	1.03	1.04	1.04	1.00	0.94	1.05
60% Equity	0.97	0.98	0.95	1.00	0.94	0.97
100% Equity	0.94	0.95	0.92	1.00	0.95	0.94
<u>Deficit Funding</u>						
0% Equity	4.93	5.26	5.81	0.96	0.63	6.38
30% Equity	1.09	1.10	1.10	1.00	0.96	1.12
60% Equity	0.99	1.00	0.98	1.00	0.95	1.00
100% Equity	0.97	0.97	0.94	0.99	0.96	0.96

Figure 1. Graphs of Pension Expense Volatility – Minimum Funding

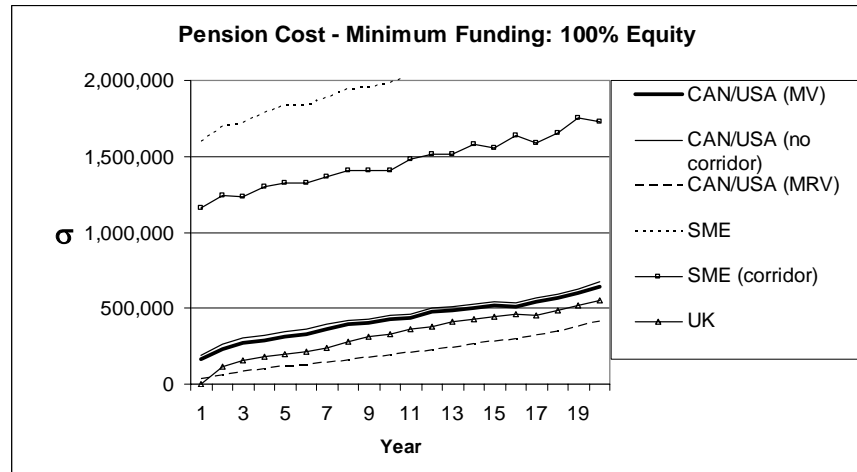
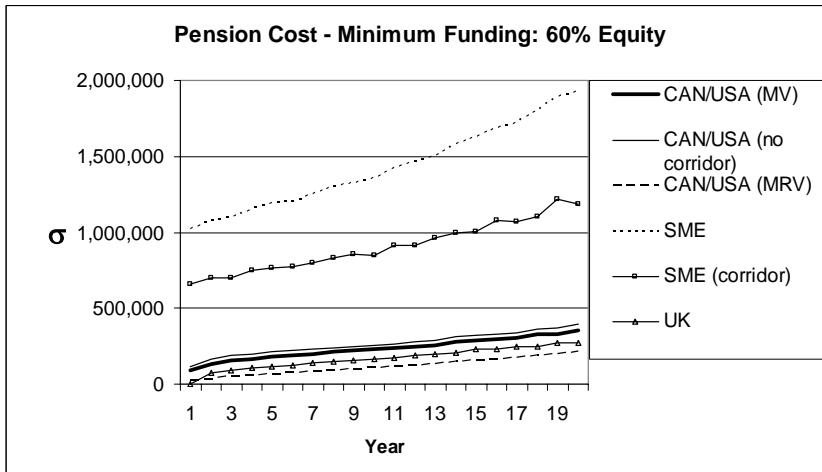
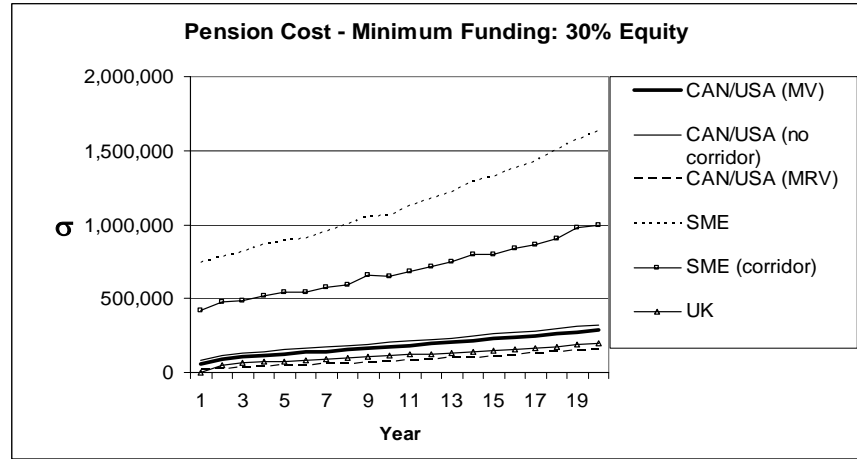
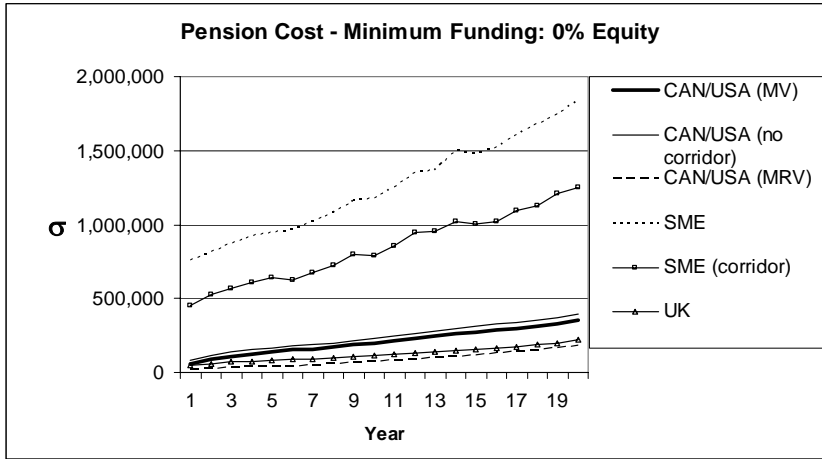


Figure 2. Graphs of Pension Expense Volatility – Deficit Funding

